View metadata, citation and similar papers at core.ac.uk

brought to you by CORE

provided by Universiti Teknologi MARA Institutional Repository

UNIVERSITI TEKNOLOGI MARA

THE DOCTORAL RESEARCH ABSTRACTS

Volume: 11, Issue 11 April 2017

ELEVENTH ISSUE

INSTITUTE of GRADUATE STUDIES

IGS Biannual Publication

29

Name : MUHD NORHASRI MUHD SIDEK

Title : UTILISATION OF NANO MATERIALS IN ENHANCING STRENGTH AND DURABILITY PROPERTIES OF ULTRA HIGH PERFORMANCE CONCRETE (UHPC)

Supervisor : PROF. DR. HAMIDAH MOHD SAMAN @ HJ. MOHAMED **(MS)**
DR. MOHD FADZIL ARSHAD **(CS)**

Hydration gel (C-S-H) is major component in binding of concrete and refining of the C-S-H gel is difficult to be done by using micro based materials. For this research, inclusion of nano materials in UHPC is expected to overcome the problem by providing ultra filler effect. In this study, the utilisation of nano material in UHPC was done by using additive or replacement method for cement and UHPC mix and generated based on a series of trial modified mixes originally formulated by previous researchers. For this research, two types of nano materials were selected. Firstly, nano kaolin samples were prepared from kaolin using milling and then underwent calcination process to produce nano metakaolin. Secondly, nano clay was provided by Sigma (M) and underwent calcination process to convert to nano metaclay. Characterisation of cementitious materials were confirmed by its particle size, chemical composition and morphology properties and evaluated using Laser particle Analyser, X-Ray Fluorescence (XRF), X-Ray Diffraction (XRD) and Scanning Electron Microscope (SEM). UHPC mixes were developed by incorporating nano materials with (addition) and without (replacement) addition of metakaolin. The inclusion of nano materials as an additive and cement replacement material (without metakaolin) based on percentage of increment from 1, 3, 5, 7 and 9 %. For additive approach, addition of metakaolin was fixed to 10%. The utilisation of nano materials was assessed in terms of its cementitious, microstructures and chemical phases, strength and durability properties. In cementitious properties, cement paste were determined in terms of setting time and compressive strength. In fresh state, workability of UHPC was determined by using slump test. For strength properties compressive and flexural strength were tested. Finally, durability properties were assessed based on porosity and water absorption characteristics. UHPC specimens, containing nano materials were assessed its chemical phases and microstructure using XRD and SEM examination. Moreover, data from strength and durability properties was optimise by using Design Expert Software and mathematical equation generated. It was found that, particles of nano materials performed different morphology as compared to the OPC, kaolin and metakaolin. For cement paste, inclusion of nano materials as addition or replacement increase the water demand but also increase compressive strength as compared to the OPC and metakaolin pastes. Strength and durability properties of nano materials enhances the UHPC performance by refining microstructure, promoting pozzolanic reaction and creating nucleation process and proves from the result provided by XRD pattern and SEM micrograph analysis.